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Statement of

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Administrator

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

before the

Committee on Aeronautical and Space Sciences
United States Senate

Mr. Chairman and Members of the Committee:

It is an honor for me to appear before the Committee today to present NASA's authorization request for Fiscal Year 1973 and to highlight the main features of the programs in aeronautics and space which we are recommending.

Accompanying me today in presenting our FY 1973 program are Dr. George M. Low, Mr. Willis H. Shapley, and the principal officials directly in charge of the operations of the Agency. I believe all of these gentlemen are well known to the Committee from their previous appearances.

During this week of FY 1973 authorization hearings, we will also be celebrating the 46th anniversary of Dr. Robert H. Goddard's successful launch of the world's first liquid-fueled rocket. When the anniversary of Dr. Goddard's first launch

comes each year, I often wonder what he would think of what we have done as we travel the road he started us on and how he would view the decisions we are making on our future course in space and aeronautics.

This year, if he were to join our review of NASA's FY 1973 budget and the plans for the future on which it is based, I believe he would be pleased. He would be disappointed, as I am, that some of our major goals are now set back even farther in the future than last year. But he would be gratified that we have the solid support of the President's decision to proceed with the space shuttle and have, in the FY 1973 budget, the support we need for a realistic and balanced total program in space and aeronautics which will continue our advances through the 1970's and provide the base for even greater accomplishments in the 1980's.

I regard the FY 1973 budget, Mr. Chairman, as marking the end of a difficult transition period for NASA. For the past two or three years, NASA, the Executive Branch, and the Congress have been grappling with questions on the course the nation's space program should take in the 1970's and beyond. The main goals in science, exploration, and applications, and the advanced systems and technology required to achieve these goals, have been identified, presented, and generally approved in

NASA's authorization and appropriation requests for FY 1972 and the preceding years.

But there has remained a basic uncertainty, an uncertainty which has been a serious concern to all leaders and supporters of the space program, as well as the principal and almost the only target of those who have tended to criticize or even oppose the program. This is the question of cost. Can the nation afford the space program of the 1970's? Will the approval of the space shuttle and the other programs planned in space science, exploration, applications, technology, and in aeronautics commit the nation to a large increase in future spending levels?

This year we can give clear answers to these questions. We can assure the Committee, the Congress, and the public that the program we are proposing does not commit the country to higher budget levels in future years, measured in current dollars.

We have made some fundamental changes in our program planning during the past year. The program as planned last year would have required NASA appropriations in future years to approach $4 billion per year. As reported to the Committee, run-out costs alone, i.e., the costs to continue and complete without new starts the program as then planned, would have risen to $3.7 billion in FY 1973 and $3.95 billion in FY 1974.

The program as now planned has estimated run-out costs of $3.37 billion in FY 1974, $3.3 billion in FY 1975, $3.2 billion in FY 1976, and $3.1 billion in FY 1977. This means that under the revised plan we will be able, by properly phasing-in the start of needed future new programs, to hold total NASA appropriations in future years to approximately the current total appropriations level, in current dollars. The chart attached to my statement shows graphically the difference between the previous and present plans.

The revised plan is, I believe, more realistic and will give the nation a good, viable, and balanced program in aeronautics and space at a cost it can afford.

The revised plan is not a commitment to a constant NASA budget in future years. Changes in the purchasing power of the dollar, as wage and price levels change, will have to be recognized. The President and Congress may decide that the program as now planned should be augmented or accelerated. But under the revised plan the program no longer contains a built-in commitment to higher budget levels. The decision can be made each year in the review of the proposed authorizations and appropriations.

I strongly believe that this posture of a realistic long-term plan in which the nation's commitment is limited to budgets

of approximately the current size is the proper posture for NASA from the standpoint of responsible management. I also believe that the fact that we have a plan that achieves this posture is the direct answer to the concerns of those who have believed that in embarking on the space shuttle and other new programs of the 1970's we are committing the nation to a program that it cannot afford.

To achieve this posture, we have had to make some basic changes in our planning and have had to accept yet another stretch-out of the period over which our continuing and long-term objectives in space exploration and space science will be achieved.

SPACE SHUTTLE PROGRAM

The principal change has been in the space shuttle program. The space shuttle configuration we now plan will cost about $5.5 billion to develop, about half of what the initial concept under study a year ago would have cost. My letter of January 14, 1972, reported in detail on the progress and results in our studies last year which led to the configuration concept decision approved by the President on January 5, 1972. I expect that in the near future we will be in a position to make and announce final decisions on the booster and some open

technical details and then proceed to issue a request for proposals to contractors. After that, we will be able to reach a decision on the launch and landing site.

I am sure that this Committee is fully aware of the reasons for the central importance we attach to the space shuttle for the future of the United States space program. In brief:

-- The shuttle will provide the means for routine, quick reaction, and economical access to and return from space needed for scientific, applications, and military uses of space in the 1980's and beyond.

-- The shuttle will reduce the cost of space operations substantially. With space budgets at about current levels, the total savings to NASA, DOD, and other users are estimated at about a billion a year in the 1980's.

-- Finally, the shuttle will assure that the United States will have a continuing effective presence in space. Without it there would be no U.S. manned space flights after the Apollo and Skylab missions are completed.

Mr. Chairman, I will not dwell longer on the shuttle today since it will be discussed fully when Mr. Myers testifies tomorrow. Before moving on, however, I would like to emphasize two points:

First, the $5.5 billion development cost of the space shuttle is included in the estimated future "run-out" costs of our FY 1973 program cited above. All of NASA's costs in future years for developing the shuttle, for providing the necessary facilities, for putting the shuttle into operation, and for using it effectively, can be accommodated in a total NASA program and budget at approximately the current level of NASA appropriations, in current dollars.

Second, the steps we have taken and are taking on the space shuttle now in FY 1972 are fully in accord with the plan and approach for the space shuttle presented to and approved by Congress in our FY 1972 authorizations and appropriations. This plan and approach, you will recall, was that we would proceed in FY 1972 with engine development and would continue studies or initiate development of the shuttle itself, depending on the progress in the studies. We will, of course, continue to keep the Committee currently informed of significant developments and decision points as they occur.

EXPLORATION OF THE OUTER PLANETS

A second significant change in our plans of last year has been a cutback in our planned program for the exploration of the outer planets. Last year we proposed starting the development of an advanced spacecraft, called TOPS, to explore all of the outer planets--Jupiter, Saturn, Uranus, Neptune, and Pluto--during the unique opportunities for "Grand Tour" missions in the late 1970's. To meet these launch opportunities, and because of the advanced technology to be used, this program would have been quite costly and imposed heavy funding requirements in the next few years. Partly for these reasons, the Grand Tour program although highly attractive from many standpoints, received less than wholehearted support from some in the scientific community and the Congress who believed that a less ambitious and less costly plan would be preferable.

We have, therefore, reduced and redirected the program to focus in the later 1970's on Jupiter and Saturn with less expensive Mariner-class spacecraft. This action maintains a program of outer planet exploration and assists us in avoiding substantial increases in future NASA budgets.

NUCLEAR PROPULSION PROGRAM

A third significant change is in the nuclear propulsion program. As reported in my letter to the Committee of January 24, 1972, it has been decided to terminate the NERVA program for developing a 75,000-lb. thrust nuclear rocket engine. Under last year's budget we have been in a holding position in this program to see whether development of this engine should be resumed. The stretch-out in our future plans necessary to avoid large budget increases in future years served to push even farther into the future the earliest times we could hope to mount missions that would use the NERVA engine. This fact, together with the need to hold our budget level down in the 1970's, led us reluctantly to the conclusion that reinstatement of NERVA development could not be justified at this time and that the existing development contracts should be terminated.

However, we have no doubt but that there will ultimately be a need for nuclear propulsion in the space program. The investment over the years in nuclear propulsion technology development and in the NERVA program has provided lasting values in preparing ourselves for the time a nuclear engine is required.

Cancellation of the Grand Tour missions has introduced a new class of future missions for which a smaller nuclear rocket engine, much smaller than NERVA, may be particularly well suited: the first missions with relatively small spacecraft, to the most distant of the outer planets--Uranus, Neptune, and Pluto. Now that we will miss the unique opportunity for the gravity assisted Grand Tour missions, a new high energy propulsion system will be needed to reach these planets. A nuclear rocket engine in the 15,000-20,000 pound thrust class may well be the answer. For this reason, we have included $8.5 million in our FY 1973 budget to proceed with AEC in defining a nuclear rocket engine in the 15,000-20,000 pound thrust class and conducting the trade-off studies necessary to establish the preferred propulsion system for missions to these distant planets some time in the 1980's.

AERONAUTICS

The final major change in our program from last year is the significantly increased emphasis we are placing, within our total budget, on aeronautics. The joint Department of Transportation-NASA Civil Aviation Research and Development ("CARD") Study, which was undertaken at the request of this Committee and completed last year, showed clearly what the needs are. The FY 1973 budget supports NASA efforts to meet them.

For example, we will intensify our efforts on the QUESTOL program--the name we now give the program for the development of an experimental quiet short take-off and landing research aircraft we are starting in FY 1972. We will also begin work on an engine modification kit--using new technology developed by NASA, DOT, and industry--which can permit airlines to reduce the objectionable noise of older jet engines. These are but two elements of the clearly laid out program we have developed to attack the top priority problems facing the nation in civil and military aeronautics. I believe that this program is responsive to the strong urgings of this Committee that more and better focussed attention be given to aeronautics.

CONTINUATION OF SPACE FLIGHT PROJECTS UNDERWAY

Now, Mr. Chairman, I would like to review briefly the major space flight programs approved in previous years which are included in our FY 1973 budget request.

-- The Apollo program will be completed in FY 1973. Apollo 16 now scheduled for launch April 16, and Apollo 17 this December will make the last Apollo scientific expeditions to the moon. We believe these missions will surpass even the spectacular results of Apollo 15 in adding entirely new

dimensions to our understanding of the moon and its significance for a better understanding of the earth.

-- Skylab, our experimental space station, now in the crucial qualification phase of development, will be placed in orbit in 1973 for our astronauts to conduct the wide range of planned experiments in earth resources, solar astronomy, medical, and other fields.

-- Mariner 9 is now daily sending back exciting new information on the planet Mars. As I will mention later, in a real sense we are discovering, with this information, a new planet, much different from what was known or expected from ground observations and the relatively brief glimpses from Mariners 4, 6 and 7.

-- Viking is on schedule to make our first landings on Mars in 1976 with scientific instruments that should make another giant leap in our understanding of this planet and its similarities and differences from the earth. The most recent information from Mariner 9 has greatly increased the possibility that some form of life may be found on Mars.

-- Pioneer 10, which was successfully launched on March 2, and Pioneer G will be man's first missions

through the asteroid belt to Jupiter and will be the first man-made objects to escape from the solar system into interstellar space. Pioneer 10 is now travelling 20,000 miles per hour toward its fly-by rendezvous with Jupiter in December 1973.

-- Going in the other direction, a Mariner spacecraft will swing by Venus to Mercury in 1973, and in 1974 and 1975 Helios, our cooperative project with West Germany, will fly three-quarters of the way to the sun to make the closest solar observations ever made.

-- Orbiting observatories will continue to push back the frontiers of the cosmos with their observations of features of the universe that are invisible from the surface of the earth. OAO-2, launched more than three years ago, is still hard at work. OAO-C, with a different and more complex set of ultraviolet measuring instruments, will be launched this summer. Development of the new High Energy Astronomical Observatory (HEAO) to look systematically at the mysterious X-and-gamma-ray sources deep in the universe will proceed, aimed at launches in 1975 and 1977. We will also proceed as planned with OSO I, the advanced satellite to observe

the sun, but have deferred, at least for now, work on further satellites in this series.

-- Last--in order in my statement but perhaps first in importance--are our applications satellites:

- The launch, early this summer, of ERTS-A, the first experimental earth resources survey satellite, will be a major milestone in the development of practical uses of space. The more than 300 experiments with ERTS data planned by over a dozen agencies will represent the most massive effort to date to explore experimentally the direct uses and benefits of space for men on earth.
- The practical uses of weather satellites will continue to be pushed with the launch of the first SMS stationary weather satellite, further sensor experimentation with Nimbus satellites, and initiation of development of TIROS N--the only new space project included in the FY 1973 budget--to incorporate the advances of recent years into the nation's operational weather satellite system.

- In the communications field, advanced technology and user experiments will be conducted with ATS F, and ATS G.

Now, Mr. Chairman, I would like to mention briefly several matters which I believe will be of interest to the Committee.

INTERNATIONAL ASPECTS

During 1971 we continued our efforts related to international participation in our programs and we made encouraging new progress with the Soviet Union.

During the year, we launched scientific satellites prepared and funded by Canada, Italy, France, and the United Kingdom, as well as a West German scientific probe. At the same time, work continued on five other cooperative satellite projects, including Helios, the NASA/German probe of the sun, and the NASA/Canadian Communications Technology Satellite.

In the field of earth resources surveys we continued our efforts to promote a sound understanding of the potential benefits of satellite remote sensing. We have already accepted proposals for 37 investigations from 22 countries which will utilize data acquired by the Earth Resources Technology Satellite and the Earth Resources Experiment Package on Skylab.

With regard to the prospects of European participation in the development of the post-Apollo transportation system, there is a clear interest in Europe but the eventual results are far from clear. European agencies have spent some $6 million in post-Apollo studies, some in direct support of our contractors. Their technical experts have been meeting with NASA experts to identify specific tasks which Europe might contribute to our mutual advantage. The President's decision that the United States should proceed with the development of the space shuttle has introduced a note of urgency. It is not yet clear that Europeans can make timely decisions on participation consistent with NASA plans to begin development work on the shuttle July 1.

Our experience under the agreements with the Soviets of 1970 and 1971 continues to be encouraging. Three Joint Working Groups on compatible rendezvous and docking systems met twice during 1971, once in Houston and once in Moscow. They made significant progress toward completing the definition of technical requirements for compatible systems for future U.S. and Soviet manned spacecraft. These Working Groups have also been studying the technical and economic implications of experiments that might be conducted to test and prove out

compatible systems. A first such test mission might be the docking of an Apollo-type spacecraft with an orbital space station of the Salyut type. No decision has been made on conducting such a mission but we are taking the steps necessary to preserve the option for using surplus Apollo and Saturn IB hardware for this purpose.

Under a separate agreement with the Soviets, we have exchanged lunar samples brought back by Apollo for those returned by the Soviets' unmanned probes. In addition, we have exchanged telex reports on findings of special interest by the U.S. and Soviet missions to Mars, participated with Soviet scientists in a NASA Lunar Science Conference this past January, and initiated the regular exchange of meteorological rocket data.

CIVIL SERVICE PERSONNEL

The FY 1973 budget request reflects a reduction of 650 positions in NASA civil service personnel, in addition to the FY 1972 reduction of 850 which was made last year after our FY 1972 budget had been approved by the Congress. These reductions, in effect, represent the application to NASA of the 5% across-the-board reduction in personnel ordered by the

President last August. We had hoped to accomplish these reductions by attrition, but it now seems likely that reduction-in-force actions will be necessary at most NASA Centers and at Headquarters.

These most recent reductions, totalling 1,500, come on the heels of the 1,500 reduction previously planned in our FY 1972 budget and yet another 1,500 reduction the year before. With our overall budget level and program now stabilized, I believe that our civil service employment should likewise be stabilized at the 26,850 position level we will reach at the end of FY 1973. At this point, Mr. Chairman, I would like to submit for the record a statement by Mr. Richard C. McCurdy, our Associate Administrator for Organization and Management, on the results of his study of NASA's institutional base and personnel requirements.

FACILITIES

I would also like to submit for the record, Mr. Chairman, a statement by General Robert H. Curtin, the Director of Facilities, which details our FY 1973 requirements for Construction of Facilities. I should also mention that, in the area of facilities, I have approved the recent report of the Facilities Management Review Committee, appointed by

Dr. Low last year, which was made available to the Committee in January. The authorization bill before you reflects its recommendations. I believe that by implementing this report, we can achieve substantial improvements in this area. I wish to express NASA's appreciation for the cooperation of the Committee and its staff in developing improved methods for handling facilities matters.

IMPORTANCE OF THE NASA PROGRAM

In conclusion, Mr. Chairman, I would like to devote a few minutes to summarize our views on the importance of our programs in aeronautics and space.

In the allocation of funds to support the multitude of Federal agencies and programs each year, hard decisions are made based upon an overall consideration of national priorities and needs. And on this basis, there are some who urge sharp reductions in NASA's program. But, when we consider the very real benefits of NASA's program -- in advancing scientific knowledge, in exploration, in the practical applications of aeronautics and space, and perhaps most importantly in meeting the need for the United States to have a continuously advancing technology -- and when we consider that the NASA portion of the overall Federal Budget for FY 1973 amounts to less than 1.3 percent, I am firmly convinced that NASA well justifies its present place in any objective ranking of national priorities.

Let me review some of the different kinds of benefits resulting from our programs in aeronautics and space.

In exploration and science the benefits are usually long-term in nature, but are nonetheless real. Take, for example, Mariner 9, which has been orbiting Mars for the last 3½ months and has acquired a wealth of outstanding scientific data on that planet and has unravelled a number of mysteries which have intrigued the earth-based scientists for centuries. I will take a moment to try to explain why this is important.

From Mariner 9's numerous high resolution pictures of the Martian surface, a number of close-up views of its two moons, and almost continuous measurement of the changing atmospheric conditions on Mars, a completely new picture of the planet is now emerging. It appears that both the surface and the atmosphere of Mars are extremely dynamic. Abundant evidence has accumulated suggesting that, like the earth, Mars is volcanically active and some time during its history may have witnessed large outpourings of gases and liquids which have been the basic building blocks of life on the earth. Calderas, faulty terrains, deep canyons, and dried-up meandering rivers clearly seen in the television pictures, all point to a continuously evolving Mars whose history may

have been completely different from that of the moon and may be following that of the earth, but at a slower pace because it is a smaller planet.

A major problem facing physicists studying the earth's atmosphere at the present time is what will be the effect of changes in the earth's atmosphere on the global climate. The problem is complex for theoretical analysis because of our poor understanding of the mechanism by which a cooling or heating of the earth will influence the dynamics of the atmosphere and whether the dynamical effects may not be large enough to offset the initial change in temperature. Now, for the first time, we seem to have actually witnessed the cause and effect of this phenomenon on Mars and will be able to extend the results to gain a better understanding of changes that may occur to the earth. As you know, Mariner 9 reached Mars at a time when an extensive dust storm was raging over the whole planet. The numerous temperature and pressure measurements carried out by Mariner 9 on the atmosphere and surface of Mars during and after the dust storm will be another direct input to our understanding of the behavior of our own atmosphere.

I have taken the time to go into this, Mr. Chairman, because it shows that even our most remote activities in space have a real relevance to problems on earth.

To continue, the direct benefits in our space applications programs -- weather satellites, communications satellites, and, in the future, earth resources satellites -- can be measured almost immediately in terms of dollars, or convenience, or even in terms of human lives saved.

Most significant of all, perhaps, are the direct benefits of advanced aeronautical and space technology. To meet the pressing social problems of our times requires above all a sound economy operating at a high level of employment to generate the tax revenues required at all levels of Government. To maintain such an economy in a competitive world, we must increase our productivity year after year, decade after decade. The only way in the long-term to keep increasing our productivity is through advancing our technology.

I know of no other activity which has done and can do as much to keep the U.S. strong in advanced technology as NASA's programs in space and aeronautics. Maintenance of

technological leadership is a long-term matter. It takes many years for new technology to have its effects on the economy. But the problem is before us now. In 1971, the United States for the first time had an annual trade deficit, a net total deficit of over $2 billion. But this deficit would have been three times that amount had it not been for the favorable balance of trade of almost $4 billion the United States achieved in the aerospace field.

Finally, there are many indirect benefits of NASA's programs which are often referred to as "spinoffs" or "technology transfers." Such benefits flow inevitably from our work in advanced research and development. Some are quite predictable. The relentless demands placed upon the American computer industry to meet the needs of the space program, for example, challenged that industry to advance both its hardware and the programming and contributed greatly to its dominant position in world markets.

Similarly, we know from our studies that NASA contractors having both aerospace and commercial product divisions regularly transfer the new capabilities developed under NASA contracts to their commercial product lines. For example,

the Chrysler Corporation reports that the electronic ignition system now in use in 1972 Chryslers -- which system eliminates the potentially troublesome distributor and breaker points and the condenser -- is a "spinoff" of technology developed in the space program. With your permission, Mr. Chairman, I would like to submit for the record the complete Chrysler report, with the observation that this company is just one of the thousands that have worked on NASA programs.

Other indirect benefits of our programs in aeronautics and space would have been less predictable. For example, a new rubber-like material, originally developed by the Jet Propulsion Laboratory during research to develop an improved binder for solid rocket propellants, has the potential of serving as a greatly improved material for patching concrete roads. This material, which dries faster and is easier to apply than present materials, is now being tested by the California Division of Highways and, I understand, will soon be tested here in the District of Columbia.

At this point, Mr. Chairman, I would like to place in the record a statement by Mr. Daniel J. Harnett, Associate Administrator for Industry Affairs and Technology Utilization,

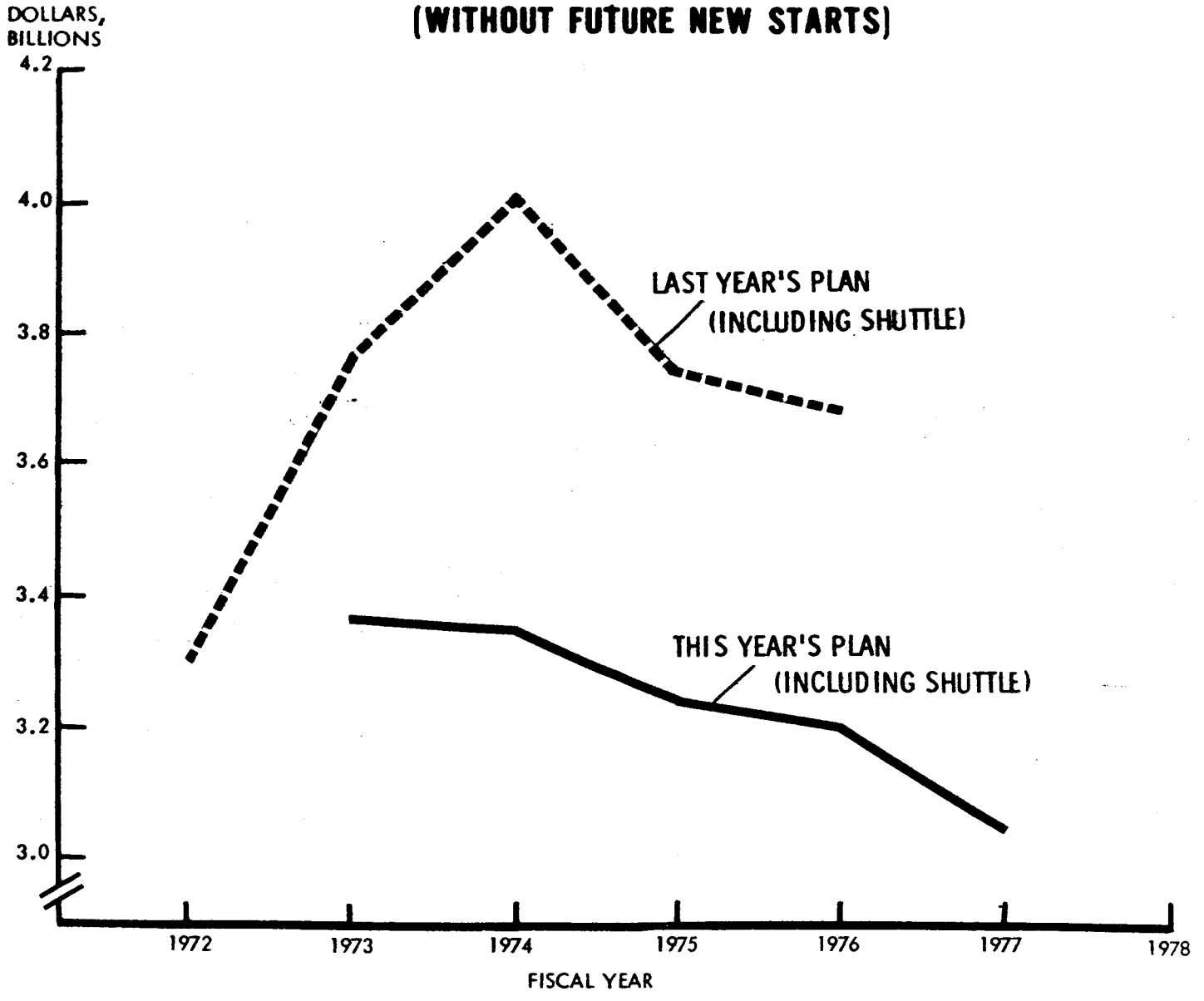
which reports on our efforts to encourage the use of space technology in other fields and identifies further examples of indirect benefits of our programs.

CONCLUSION

Mr. Chairman, our FY 1973 authorization requests total $3,379,000,000, only slightly above the totals approved for FY 1971 and FY 1972 as shown in the table attached to my statement. The proposed authorization will support a balanced and forward-looking program in aeronautics and space which will over the years have significant benefits to the United States. In the space shuttle program, we have the key element for practical and economical future uses of space. And we have an overall program plan which does not commit the nation to a higher level of appropriations in future years.

Mr. Chairman, this concludes my prepared statement.

COMPARISON OF RUNOUT COSTS
(WITHOUT FUTURE NEW STARTS)



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FY 1973 Authorization Request
(In thousand of dollars)

	FY 1971 Budget Plan	FY 1972 Budget Plan	FY 1973 Authorization Requests
Research & Development:			
Apollo	913,669	601,200	128,700
Space Flight Operations	507,300	682,775	1,094,200
Advanced Missions	1,500	1,500	1,500
Physics & Astronomy	115,956	110,100	156,600
Lunar & Planetary Exploration	144,900	291,500	321,200
Bioscience	12,898	---	---
Launch Vehicle Procurement	124,900	151,300	191,600
Applications	166,960	187,500	194,700
Aeronautical Research & Technology	100,132	110,000	163,440
Space Research & Technology	105,004	75,105	64,760
Nuclear Power & Propulsion	55,200	27,720	21,100
Tracking & Data Acquisition	289,943	264,000	259,100
Technology Utilization	4,000	5,000	4,000
Total R&D	2,542,362	2,507,700	2,600,900
Construction of Facilities	28,755	52,700	77,300
Research & Program Management	722,134	726,387	700,800
TOTAL NASA	3,293,251	3,286,787	3,379,000

NASA-HQ